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IS BI RATE EFFECTIVE? : AN INVESTIGATION OF TAYLOR RULE APPLICATION IN INDONESIA

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Abstract. *This research examines the effect BI rate towards the economic condition of Indonesia, measured by various variables using the Taylor Rule methods. This study has a purpose to measure the effect of BI rate to the Indonesian economics to see the effectiveness of BI rate towards Indonesian Economics. Considering the fluctuating Indonesian economics, the research seems necessary. The methodology used on the paper will be VAR (Vector Auto Regression). The type of VAR used will be determined in the paper based on the type of the data through various tests. This paper concludes with a discussion of recommendation, and the limitations of the research. Some researcher and economic watchers have considered that BI rate ineffective because of various reasons. The results was BI rate is not significantly affect other variables in Taylor Rule and some variables like Inflation are the one significantly affect other variables.*

Keywords: *BI rate, economics, inflation rate, Gross Domestic Product, Taylor Rule*

Introduction

The Indonesian economics, seen from the perspective of statistics, has shown instability. The inflation rate has gone from around 3% to the peak of 13% in 2006. The instability of inflation can evoke bad economics condition of a country. If the inflation goes too high, the consumers of goods and services could not afford to buy the products or use the service. If the inflation goes too low, the producers of goods and services would reluctant to produce their products because the price has gone too low. The instability is also shown by the instability of the economic growth, the economic growth is determined by the growth of Gross Domestic Product (GDP) for each year. The growth ranged from under zero percent to 6.1 percent. The value of the growth is often less than the target assigned by the government of Indonesia. There are so many important factors which affect the economy of Indonesia, one of them is Banks.

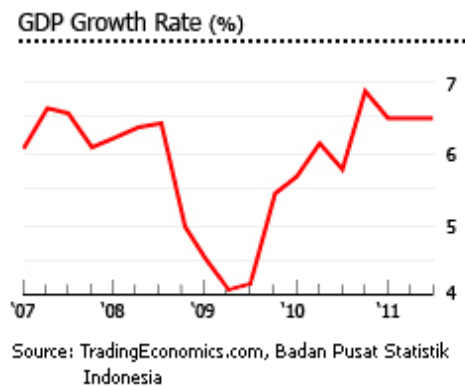
Bank is a very crucial and important factor for Indonesian economics. As one of the bank task for Indonesia economy is to become the intermediate factors for the debtor and creditor. The banks in Indonesia is ruled and regulated by the central bank of Indonesia, named Bank Indonesia. According to UU no 23 tahun 1999, the one and only job for Bank Indonesia is to stabilize the value of Rupiah against the inside and outside depreciation. The measurement to indicate the value stabilization is stated from the inflation rate, seen from the inside depreciation, and the stability of Indonesian rupiah valuation to foreign rates, seen from outside depreciation.

One of the main activities of Bank Indonesia is set the Interest rate of Indonesian Bank, the rate is often called Bank Indonesia Rate (BI rate). Bank Indonesia set the BI rate every month based on the decision

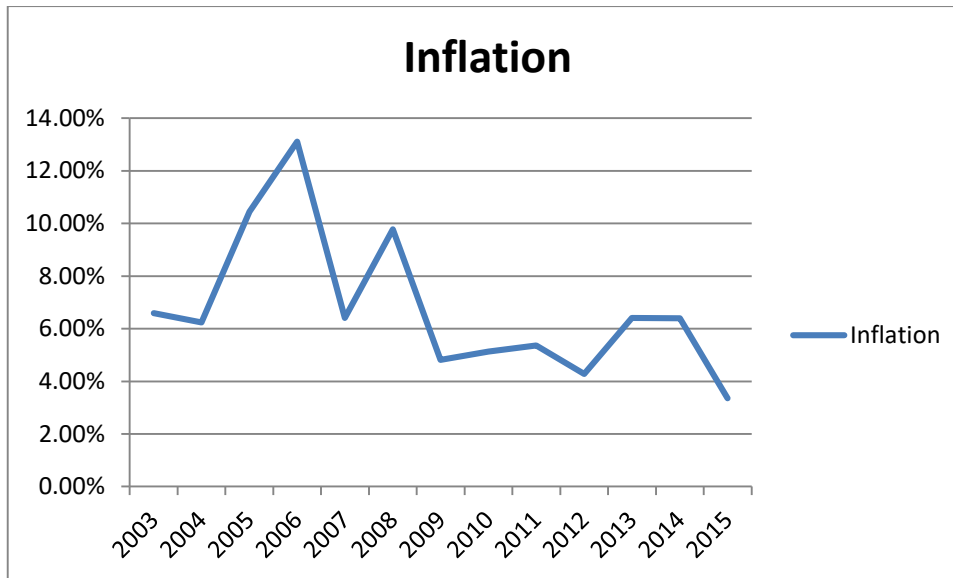
of the Bank Indonesia Board meeting. BI rate is implemented in Bank Indonesia monetary operations to achieve the monetary operational target. BI rate is set to maintain the inflation rate and economic growth in Indonesia.

The connection between GDP, inflation, and interest rate has always been computed and shown by the Taylor rule. The Taylor Rule, invented by John B. Taylor in 1993, intended to explain the rule to determine the interest rate, set by The Fed, or other National Monetary Policy Committee, such as Central Bank. The rule explain that the monetary policy committee need to set the interest rate based on the previous GDP and inflation, compared to the target set for the previous time-ranged. The research on the Effect of the Taylor Rule in the Central Bank are essential as the Interest rate set by the central bank are determined to prevent greater inflation in the future and increase the economic growth of a country, so the research takes place in finding the relationship and connection between each of the factor to determined whether the factor really affect each other significantly or not.

The economic condition of a country depend much on the activity of Banks within the country, this condition means that Banks in our country, Indonesia, is an important aspects of the Indonesian economic. According to Asian Development Bank, the economic growth in Indonesia has been slowed to 4.7% for the date of January to June 2015.



The graph above shows the GDP growth rate of Indonesia through the year of 2015, from the year of 2007 until the year of 2011. From the graph, it is shown that the growth rate of Indonesia is unstable with the fluctuation is significant for each consecutive years. The lowest growth even exist in the year of 2009 with only 4 percent of growth



The chart above is showing the inflation rate in Indonesia from the year of 2003 to 2015. The rate is representing the inflation for the January to January inflation for each year.

Taylor Rule has been agreed to become one of the rule applied by Central Bank to generate interest rates to optimizes economics condition, but the result of the application of the Taylor Rule for the Central Bank still produce some issues unsolved, and some academics views still differ on the application of the Taylor Rule would be the best for practice, some research still maintain the Taylor Rule to be the one with advanced practice in Central Bank. There are some academics which claims that Taylor Rule can misguide policy-makers in generating the most optimized interest rates (Athanasios Orphanides,2003), there are some arguments claims that Taylor-Rule cannot be directly applied to all country in the world as all countries have different condition (Joselito Basilio,2012). This condition also applied in Indonesia as Indonesia would have different condition with other country so the application of Taylor-Rule should be further researched. The Interest rate in Indonesia is called BI rate, issued by Bank Indonesia. In Indonesia there are issues in Indonesia that the banks regulated by Bank Indonesia do not follow the rates issued by Bank Indonesia. Bank Indonesia issued BI rate each month, but the banks do not adjust their rate according to BI rate, the condition will likely make the BI rate become an ineffective way to maintain economics condition.(Marta, 2016)

This research is aimed to understand and know the effect of one of the Bank Indonesia Regulation and Policy, which is Interest rate, affects the Indonesian Economics, the factor for Indonesian economics is the Inflation of Indonesia and the Gross Domestic Product growth of Indonesia for each year. The inflation and the GDP growth have to reach the target set by the government of Republic Indonesia. Furthermore, this research also determined which factor really affects the other factors for Indonesian case. By knowing the factor which is the most significant to the other factors, the Central Bank of Republic Indonesia can set better policy and better consideration of setting the interest rate to maintain the stability and reaching the target set by the government of Republic Indonesia.

A Review on Literatures

Inflation and its effect

Inflation rate of Indonesia is very unstable for each consecutive year, causing the economic growth become slower than it should be. The effects of Inflation in economics have been described and explain by economist Irving Fisher (1930), the explanation is later called by fisher effects. The theory of fisher effects describes the relationship in both real and nominal rates. The theory state that the real interest rates is produced by normal interest rates minus inflation rate, which means that the real interest rates is fall by the increase of inflation. The fall of real interest rates can cause the money growth longer when it is viewed from the perspective of purchasing power. When the purchasing power of people in a country has been reduced, the state of economic of the country would surely fall to bad condition. Michael Sarel (1996) conclude that if the inflation rate is low, it has no significant effect on economic growth, but when the opposite things happened, which is the inflation rate has gone too high, there is significant negative effect toward the economic growth. The effect has been proved to be robust, very significant and very powerful. Michael Sarel, also stated on his paper, conclude that the break point of inflation for a country is approximately 8 percent.

About Taylor Rule

Taylor Rule is a formula developed by Stanford University economist, John Taylor. The formula purpose is to give some kind of "recommendation" for the Central Bank of a country, such as The Fed or Bank Indonesia, to set their short term interest rates as the economic condition changes to reach short run goals and long run goals for economics, the short run goals means that the stabilization of economic is reach by the country and the long run goals is that the Central Bank can maintain the inflation to be stable and not reaching "too high" or "too low" point which can have negative effect on the economic condition.

The rule itself explains that there are three factors which have to be considered to adjust the "real" short term interest rate. The adjustment should be made for the inflation happened for the previous time range. The three factors which have to be considered are (1) the difference of the targeted inflation set by Central Bank for previous time range and the actual inflation happened at the time range (2) how far the economic activity is above or below its "full employment level" and (3) what level of short term interest which will be consistent with the "full employment" (Taylor, John B. 1993.)

According to Asso, Kahn, and Leeson (2007) the Taylor rule has been evolved from long debate of intellectual merits and discretion, but John Taylor managed to overcome with a theory to give a new way of thinking to the Central Bank and other Monetary policy makers. The rule was being made based on the economics condition of United States of America. They also stated that Taylor Rule should be considered a systematic response to incoming information about economic condition, rather than period by period optimization problem. Taylor Rule also have been adapted throughout the world as one of the way policy maker can determined the interest rate to be set for the country. Hofmann and Bugdanova stated that based on the views of the rule itself, the monetary policy has been systematically accommodative globally since the early 2000s.

The rule formula suggested that the short term interest rate, set by Central Bank of a country should follow this simple equation, which is:

$$r = p + 1/2y + 1/2(p-2) + 2,$$

where the symbol represents:

r = real interest rate

p = inflation

y = deviation of real GDP

According to Ben S. Benanke (2011), normally the Central Bank target is the potential output when the economy can sustainably produce when the labor are fully employed

Application of Taylor Rule in Various Country

In the year of 2010, Woon Gyu Choi and Yi Wen try to characterizes the endogenous monetary policy as a reaction of a cultural shocks, as suggested by some optimal policy literatures. They estimate the reaction function of The Fed, as the central bank of United States of America, by using structural VARs method. The research purpose is to find the "new" Taylor-rule by mapping the structural responses into a relationship between policy rate and inflation movements.

Taylor Rule has also been applied in the various developed country and brings positive effects regarding of the application, Beju and Ulici (2015) found out that the Taylor Rule application in Romania has brought positive effects to the economics of Romania. The Taylor Rule has made the inflation in Romania closer to the target for each year. Using Taylor rule, The National Bank gives a signal designed to strengthen confidence in the national economy by lowering the interest rate, which should make the credits in national currency cheaper and stimulate economic growth through increased consumption.

Some countries in the world don't applied Taylor Rule as their policy maker, the example of the country is Denmark. But Taylor rule is able to become benchmark to know whether the policies were well-made or not. Countries like Denmark tend to make fixed level interests rate rather than fluctuating interest rates. According to Søren Hove Ravn (2012) it is impossible to know the exact course of economic events, the same applied to the choice of applying Taylor rule or other monetary policy.

The application of Taylor rule has also been argued to be different for each specific country. According to Joselito Basilio (2012), For some countries, there is an established specification of a policy rule that is applicable and econometrically significant. The behavior of monetary policy in these countries is consistent with the Taylor-rule equation involving growth, and inflation as well as previous period's policy rates. While for other countries different specifications may not be applied.

Methodology

Data Collecting

The type of the data will be quantitative data, means that the data collected be all numbers, all of the data comes from all variables will be secondary data, which taken from various sources but remain valid as all of the sources are reliable and the compatibility of each data and variables have been checked thoroughly

There are 5 types of variables will be collected for the research, the variables will be collected based on the Taylor Rule model (1993). The data are taken from various reliable sources to make sure the data are valid to be undertaken a research. The first data collected are the real interest rates, the real interest rates data will be taken from World Bank, through data.worldbank.org, and the data will be taken from the year of 1986 to 2015. The second data collected are annual inflation rate (consumer price), the data will also be taken from the World Bank free and open access data through data.worldbank.org, the data will be taken from the year of 1986 to 2015, which is 30 years, which mean 30 populations. The third data collected are GDP (current LCU), the third data are collected from World Bank free and open access data. The GDP will be collected annually from the year 1986 to 2015. The fourth data are GDP growth target, the data for the variables are collected from the RAPBN sent out by Kementrian Keuangan Republik Indonesia (Monetary Minister of Indonesian Republic) the GDP growth target data can only be collected from the year of 2001 until 2015, the data for the year 1985 until 2000 are

represented by the number calculated using regression method. The fifth and the last variables are inflation target, the inflation target data are collected from RAPBN which sent out annually by Kementrian Keuangan Republik Indonesia (Monetary Minister for Indonesian Republic), but the data can only be collected for the year of 1999 to the year of 2015, the data for the year 1985 until 1998 are represented by the number calculated from the regression function. To find the real GDP growth for each year, the number are calculated by making the percentage from previous year and present year for each year from the year of 1987 until 2015, for example, the GDP growth for the year of 1991 are calculated by

$$GDP\ growth\ 1991 = (GDP\ 1991 - GDP\ 1990) / GDP\ 1990$$

Data Analysis

First, the data should be checked whether the data has unit root or not, if the data available has unit root, the data is Stationary at level 1, if the data do not have unit root, the data can be categorized as Stationary at level 0.

The data which belongs to Stationary at First Difference should be undertaken Cointegration test. The cointegration test will test whether the variable we use for the research cointegrate with each other or not. If one or more variable cointegrate with other variables, the VECM (Vector Error Correction Model) must be used for processing the data, if none of the variables cointegrate with other variables, the data must be processed by VAR first difference method.

The data which belongs to stationary level 0 should be undertaken Correlation test. The correlation test will test whether the variables has correlation with each other. If the variables have high correlation with each other, the variables must be processed with S-VAR models, while if the variables have low correlation with each other, the data should be processed with VAR-level model.

Data Analysis

There are 5 variables used in the research, , here are the summary of the data from the 5 variables used :

Variables	Period	Min	Max	Average	St.Deviation
Inflation (INF)	1986 - 2015	3.35% (2015)	58.39% (1998)	9.68%	9.79%
Real interest rate (INT)	1986 - 2015	-24.60% (1998)	21.61% (1968)	6.29%	8.14%
GDP (Current LCU)	1986 - 2015	Rp 2,047 trillion (1968)	Rp 8,978 trillion (2015)	Rp 4,823 trillion	Rp 1,959 trillion
GDP growth Target (GDT)	1986 - 2015	-13.86% (1999)	9.59% (1990)	5.44%	4.31%
Inflation target (TINF)	1986 - 2015	4% (2015)	66% (1999)	8.61%	11.33%

Real interest rate come from interest rate minus inflation, the inflation in the year of 1998 has raised greatly which reduce the real interest rate to the lowest point in history. The lowest GDP occurred in the year of 1968, the GDP of Indonesia has grown up each year, so the lowest year is the first data taken.

The GDP growth target set by the government of Indonesia occurred in the year of 1999, this is another effect of the 1998 great monetary crisis which make the government Indonesia set the GDP target low as the foreign debt has skyrocket for the year of 1998 and a lot of Industry has collapsed. Inflation target set by the government of Indonesia was set in the year of 2015 which the current Economic coordinator Minister, Darmin Nasution assumed the inflation low because of the reasons mentioned above. The great Asian monetary crisis back in the year of 1998 was also affecting the high inflation occurred in the year of 1998 which the value of inflation has raised to around 58%. The highest GDP growth target occurred in the year of 1990 which caused by the success of food self-sufficiency program and the industry supporting program done by President Soeharto as part of Pelita V (Five years development program no. 5).

After the data has been collected, the next step was determining whether the data has a unit root or not, the method for determining whether the data in the variables have unit root or not is Augmented Dickey-Fuller Test Equation, the tests were conducted in the Eviews 9 software, the variable which been conducted Augmented Dickey-Fuller Test Equation to are GDP Growth real, GDP growth target, Inflation, Inflation target, interest rates, difference between inflation and inflation target (which later represented by the symbol DINF), and difference between GDP growth real and GDP growth target (which later represented by the symbol DGDP). The summary of the test conducted to all of the variables are shown on the table below

Variables	Unit root (yes/no)	Level/difference
GDP Growth Real	Yes	First difference
GDP Growth Target	Yes	First difference
Inflation	Yes	First difference
Inflation Target	Yes	First difference
Interest rates	Yes	First difference
DGDP	Yes	First difference
DINF	Yes	First difference

According to the Augmented Dickey-Fuller Test Equation, all of the data comes from all of the variables has a unit root, which makes all of the data into the type of Stationary at first difference [I]. Considering that all of the data belongs to the type of Stationary at first difference [I], the data should be conducted with Cointegration test. The cointegration test are testing whether the data cointegrate with each other or not. If the data cointegrate with each other, the method which should be used are VECM (Vector Error Correction Model) while if none of the data cointegrate with each other, the method which used for the research will be VAR First Difference. The mathematics models for VAR first difference are as follows:

$$D(y) = \alpha_0 + \alpha_1 D(y_{t-1}) + \dots + \alpha_n D(y_{t-1}) + \beta_0 D(x_{t-1}) + \dots + \beta_n D(x_{t-n}) \quad (1)$$

The variables which are tested are Inflation; Interest rates; Difference between real GDP growth and target (DGDP); and Difference between Inflation and target Inflation(DINF). Only the 4 of the variables will be tested because the Taylor Rule only stated the relationship between the 4 variables. The Cointegration test will be using MacKinnon-Haug-Michelis (1999) method. The test will be conducted using Eviews 9 software. The summary of the test are as follows :

Series: INF INT DGDP DINF

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.786278	64.31021	47.85613	0.0007
At most 1	0.437796	24.19019	29.79707	0.1925
At most 2	0.262018	9.217041	15.49471	0.3457
At most 3	0.049403	1.3173	3.841466	0.2511

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

From the result of the test, shown above as summary, none of the variables have Cointegration with one another. As a result, the method of VAR used on the research will be VAR first difference. The VAR First Difference models are also undertaken in Eviews 9 software. The summary of the VAR first difference model can be seen as follows:

	D(DGDP)	D(DINF)	D(INT)	D(INF)
D(DGDP(-1))	0.083098 [0.13124]	-4.46E-14 [-1.04549]	5.79E-14 [2.29127]**	-6.06E-14 [-1.55084]
D(DINF(-1))	-2.77E+12 [-0.26130]	-0.376959 [-0.52842]	0.904738 [2.13970]**	-0.549811 [-0.84102]
D(INT(-1))	-3.38E+12 [-0.38787]	0.040607 [0.06909]	0.195822 [0.56213]	-0.223941 [-0.41579]
D(INF(-1))	2.28E+13 [4.83597]***	-1.729904 [-5.45814]***	0.47473 [2.52704]**	-0.808022 [-2.78197]***

Based on the table above, in the case of Indonesia, The interest rate has no significant effect on all of the economy factors, based on Taylor Rule. The Taylor rule use forward looking methods, which means that policy-maker could predict the future growth and inflation by setting interest rates at particular rates, but the effect in Indonesia were opposite to theory proposed. The central bank of Indonesia considered previous year growth gap and previous inflation gap to determine the interest rates, but the interest rate doesn't affect the economics factors, such as inflation and growth.

The factor which affect significant to all of other economics factor is inflation from previous year. The inflation from previous year affects growth gap, inflation gap, present interest rates, as well as present inflation. First, inflation from previous year affect significantly to GDP growth gap for present year, and the effect is parallel, which means that if previous inflation was higher, than the growth gap for present

year will be increased as well, this condition in Indonesia, is different with the theory proposed by Michael Sarel(1996). In the theory, Michael Sarel proposed that if the inflation goes too high, it will affect negatively to the economic growth.

Previous year inflation also affect significantly to inflation gap for present years. Inflation gap is the difference between actual and target inflation. The effect is opposite, which means that if previous inflation increases, the inflation gap for next year will decrease. The effect is occurred because of Indonesia government policy. The Indonesia government tends to increase the inflation target for the next year if the inflation for previous year has gone too high, the increase in target will reduce the gap occurred between actual and target.

The third factor affected by previous year inflation also affects significantly to present interest rates. The relationship between previous year inflation and present interest rate is parallel, which means that if the inflation from previous year increases, than the interest rate for present year will increase as well. The condition is caused by Bank Indonesia policy which considers previous year inflation and growth to be factors in determining the interest rate for the present time. Inflation for the present year, is also affected significantly by previous year inflation. The relationship between present inflation and previous year inflation is opposite, which means that if the inflation from previous year increase, the inflation for the present year will decrease and vice versa.

Conclusion

National economy is one of the crucial factor of a country, which two of the concerning factors are economic growth and inflation. Central Bank has a crucial position in national economy condition as one of the main task of a Central Bank is to generate interest rates every period of time. The purpose of the interest rates is to maintain the stability of the country's inflation and the increase of economic growth of the country. So, central bank as one of the monetary policy maker should set the interest rate to maintain the purpose of the interest rate itself. Based on the test conducted on this research, there are some conclusions which can be drawn, the conclusions are as follows:

1. Interest rates, set by the central bank of Indonesia, which is Bank Indonesia has no significant effect on other variables on economy, such as inflation, and the economic growth. This is contradict with the purpose of the interest rate itself which is to maintain the stability of the country inflation and increase the economic growth. The condition is related to the bank in Indonesia which do not want to adjust their rate along with the changes of BI rates, this makes the BI rate not effective in affecting the Indonesian Economics.
2. Inflation has significant effect on all of the variables tested. Previous time-range inflation has been shown to be significant to economic growth, interest rates as well as present inflation.
3. Interest rates has opposite relationship with the difference of GDP for each time-range, which means that the higher the interest rates would make less difference on the growth for the next time-range.